

REMARKS

This paper was responsive to the Office Action mailed May 21, 2003. Amendment, reexamination and reconsideration of the application is respectfully requested. **Claims 1-3** were withdrawn with traverse. Reconsideration is respectfully requested. **Claims 1-23** remain in the application.

The Office Action

In the Office Action mailed May 21, 2003:

Claims 21-23 were rejected under 35 U.S.C. §102(e) as being anticipated by US Patent No. 6,463,173 B1 to Tretter ("Tretter"); and,

Claims 4-20 were rejected under 35 U.S.C. §103(a) as being unpatentable over Tretter.

The Present Application

For purposes of brief review, the present application is directed to a method system for rendering single colorant versions of color images while preserving as much information from the color image as possible and minimizing image distortion. For example, the present application is directed to a system and method for rendering black and white versions of color images. Typical color image authoring devices can produce over 16 million different colors, while typical black and rendering devices can only produce 256 shades of gray. Obviously, a great number of colors must be mapped to each level of gray. Therefore, portions of a color image that are quite obviously different colors can appear to be the same color when the image is rendered in black and white. When the image portions in question are, for example, different sections of a pie chart or bar graph, this loss of information can render the chart or graph useless (page 2, lines 5-12). The system and method of the present application addresses this problem by analyzing an image to find colors in the image that would otherwise be rendered in the same manner and altering the rendering process for one or more of those colors so that at least some of the distinctiveness of those portions of the color image comprised of the colors that conflict in black and white can be preserved in the black and white version of the image. For example, the rendering process is altered by adding a

texture to portions of the black and white version of the image that represent one or more of the conflicting colors (e.g., compare Fig. 1, 122, 126 to Fig. 9, 922, 926). For example, the texture is applied through spatial modulation. Spatial modulation may be achieved through the application of selected half tone screens. For instance, the black and white version of a first conflicting color may be rendered using a first line screen and the black and white representation of a second conflicting color may be rendered with a different or second lined screen. The subtle imaging artifacts associated with the selective screens (e.g., the striping visible in Fig. 9) restores some of the distinctiveness of the different colors in the original color image that would have otherwise been lost (e.g., Fig. 1, 122, 126). It is to be noted that the texturing or spatial modulation notwithstanding, the lightness of the rendered conflicting colors is not altered. Therefore, the lightness of the colors in the original image is preserved in the rendered black and white version of the image. Furthermore, portions of the black and white image that are not associated with conflicting colors remain unaffected. Therefore, deleterious effects of the process are minimized, thereby allowing the methods of the present application to be applied in an default or "walk-up" mode of an image processor, such as, for example, a photocopier.

The Cited Reference

In contrast, the primary reference of the Office Action to Tretter discloses a system and method for histogram based image contrast enhancement. It is respectfully submitted that Tretter does not disclose or suggest adding texture or modulation to gray levels of conflicting colors (e.g., colors associated with the same gray level) in a black and white version of a color image. Instead, Tretter discloses a method for increasing the difference in the gray level of pixels in the separations of a color image that already have some difference. For example, pixels having a gray value in one separate section of 100-102 may be remapped to values of 110-113 (e.g., 100 becomes 110, 101 becomes 112 and 102 becomes 113) (col. 9, lines 50-65). However, Tretter does not disclose or suggest a means for modulating one set of pixels having a gray level of 100 (a first conflicting color) from a second set of pixels having a gray level of 100 (a second conflicting color). Therefore, Tretter

does not disclose or suggest classifying or identifying conflicting colors and applying modulation or texture to at least one gray version of a conflicting color, thereby making gray scale versions of conflicting colors visually distinguishable from one another. Furthermore, the operations of Tretter are not restricted only to conflicting colors. Instead, it is submitted that Tretter changes the gray level values of all level pixels of an image (compare Fig. 1 and Fig. 9a of Tretter). Furthermore, Tretter is unconcern with rendering a black and white version of a color image. Tretter is only concern with taking full advantage of the color range of color printers in order to best render a color image (abstract, col. 5, lines 35-41, col. 12, lines 57-62).

It appears that the Office Action equates the gray level shift resulting from the histogram of the equalization or stretching of Tretter to the modulation disclosed and claimed in the present application. However, as disclosed and claimed in the present application, modulation is not a simple gray level shift of all the pixels of one gray level to pixels of another gray level. Instead, associating a modulation to pixels of a single colorant version of a multi-color image assigns, for example, a unique pattern to those pixels. For instance, a unique screen such as a unique line screen can be applied to the single colorant, or black and white version, of a conflicting color (page 7, lines 18-23). Some pixels associated with a given conflicting color maintain their gray level while the gray level of other pixels associated with the conflicting color are modulated or altered by or the combination with the pattern. This results in the spatial modulation or texturing depicted in Fig. 9 and Fig. 10 of the present application.

The foregoing reasons Tretter simply does not disclose or suggest the subject matter disclosed and claimed in the present application.

The Claims Are Unanticipated

Claims 21-23 were rejected under 35 U.S.C. §102(e) being anticipated by Tretter. In explaining the rejection of **claim 21** the Office Action asserts that Tretter discloses a method for rendering an image described in a multi-colorant color space in a single colorant color space. The applicants respectfully disagree. As explained above, Tretter discloses a method for enhancing the contrast in a color image in preparation for rendering the image with a color rendering device (col. 5, lines 35-41,

col. 12, lines 57-62).

Additionally, the Office Action equates Tretter's disclosure of a histogram generator, which counts the pixels in the range of values allowable for a particular property for contrast adjustment, to examining the image to find conflicting colors in the image and directs the attention of the applicants to col. 6, lines 26-34 in support of the assertion. However, while counting pixels and generating a histogram may be part of examining an image to find conflicting colors, counting pixels in an allowable range (i.e., within the range printable by a printer) is not a search for conflicting colors as disclosed and claimed in the present application.

The Office Action also asserts that Tretter discloses creating a single colorant version of the image and directs the attention of the applicant to col. 7, lines 1-5 in support of that assertion. However, the referenced section of Tretter merely discusses converting an RGB description of an image into a luminance and chrominance description of the image. However, it is respectfully submitted that both RGB and luminance/chrominance descriptions of an image are color descriptions of an image.

Furthermore, it is respectfully submitted that Tretter's assertion that his invention is "equally applicable to all color image representations" supports the applicant's assertion that Tretter is unconcerned with rendering a single colorant or black and white version of an image.

Lastly, in explaining the rejection of **claim 21**, the Office Action attempts to draw an analogy between a modified histogram of Tretter with modulating a portion of the single colorant version of the image that is associated with one of the conflicting colors as disclosed and claimed in the present application. However, as explained above, Tretter does not disclose or suggest a modified histogram adjusting a portion of a single coloring version of the image that is associated with one conflicting color. Instead, Tretter discloses modifying all or most of the colors of an image and not a portion of the image associated with one conflicting color.

For the foregoing reasons, **claim 21**, as well as **claim 22**, and **23**, which depend therefrom are unanticipated and unobvious in light of Tretter.

Additionally, **claim 21** has been amended to recite selectively spatially modulating a proportion of the single colorant version of the image that is associated

with one of the conflicting colors. It is respectfully submitted that Tretter does not disclose or suggest spatially modulating a portion of a single colorant version of an image that is associated with a conflicting color.

The foregoing additional reasons **claim 21**, as well as **claims 22**, and **23** are unanticipated and unobvious in light of Tretter.

Support for this amendment is found throughout the application and in the striped patterns evident at reference numerals 922, 926, in Fig. 9 and 1014, 1018, 1022, and 1026 in Fig. 10.

The Claims are Unobvious

Claims 4-20 were rejected under 35 U.S.C. §103(a) as being unpatentable over Tretter. In explaining the rejection of **claim 4**, the Office Action asserts that Tretter discloses applying modulation to at least one gray scale version of the conflicting colors, and at the same time, admits that Tretter fails to disclose gray scale versions. Nevertheless, in support of the assertion the Office Action directs the attention of the applicants to col. 3, lines 56-58, which explain that the modified histogram of Tretter is used to adjust the value of a first measurable propriety in a digital form, thereby producing a contrast enhanced image. However, col. 3, lines 53-56 explain that the histogram is divided into clusters and histogram equalization or stretching is performed on each cluster thereby producing a modified histogram. It is respectfully submitted that this amounts to an equalization or stretching of the entire histogram and is therefore limited to a modulation of conflicting colors. Instead, the method of Tretter is a re-mapping of all or substantially all the colors of an image.

For the foregoing reasons, **claim 4**, as well as **claims 5-9**, which depend therefrom, is unanticipated and unobvious in light of Tretter.

Additionally, the Office Action admits that Tretter fails to disclose gray scale versions of conflicting colors. In so doing, the Office Action directs the attention of the applicants to col. 4, lines 20-27 which summarize functions of a histogram adjuster. It is respectfully submitted that this referenced section is unrelated to disclosure of gray scale versions of conflicting colors. Nevertheless, the Office Action asserts that it would have been obvious to one of ordinary skill in the art at

the time the invention was made "to include versions as the desired characteristic of Tretter, to be able to better differentiate between image regions and thus improve the output image quality". However, as explained above, conflicting colors can have exactly the same luminance characteristic. Tretter discloses simply re-mapping all pixels of a first luminance to pixels having a second luminance. Therefore, Tretter cannot disclose or suggest applying modulation to at least one gray scale version of the conflicting colors thereby making all of gray scale versions visually distinguishable from one another.

For the foregoing additional reasons, **claim 4** is unanticipated and unobvious in light of Tretter.

Furthermore, **claim 4** has been amended to recite applying spatial modulation to at least one gray scale version of at least one of the conflicting colors, thereby making all gray scale versions visually distinguishable from one another. As explained above, support for this amendment is found throughout the specification and in Fig. 9 and Fig. 10 in particular. Additionally, as explained above, Tretter does not disclose or suggest applying spatial modulation.

For the foregoing additional reasons, **claim 4**, as well as **claims 5-9**, which depend therefrom, are unanticipated and unobvious in light of Tretter.

Claim 6 has been amended to recite that applying spatial modulation further comprises associating a unique modulation to the gray scale versions of each of the conflicting colors. As explained above, it is submitted that Tretter does not attempt to identify conflicting colors. Tretter discloses processing a color image to be rendered in color. Therefore, in the applications addressed by Tretter, colors do not conflict. Furthermore, even if remapping the values of pixels is considered a modulation, Tretter does not disclose that a unique remapping is associated with gray scale versions of each conflicting color. For instance, it is respectfully submitted that Tretter discloses re-mapping a plurality of luminance values upwards by a value of ten (col. 11, lines 56-63).

For the foregoing additional reasons, **claim 6** is unanticipated and unobvious in light of Tretter.

In rejecting **claim 7**, the Office Action asserts that Tretter discloses measuring a distance in RGB color space and directs the attention of the applicants

to col. 7, lines 34 - col. 8, line 20 in support of this assertion. However, the referenced section of Tretter merely describes the conversion of an RGB image into a YCrCb image and CIELab image. It is respectfully submitted that disclosure of a conversion of a description of an image from one color space into a description of an image in a second color space is not a disclosure of the measurement of a color distance between a pixel and the image and a conflicting color.

For the foregoing additional reasons, **claim 7** is unanticipated and unobvious in light of Tretter.

Additionally, **claim 7** recites applying an attenuated modulation to at least one pixel in the gray scale version of the image, the attenuation ranging from zero to one hundred percent of a reference modulation, the level of attenuation being a function of the measure color distance. The Office Action does not assert nor does Tretter disclose or suggest applying with an attenuated modulation with at least one pixel in the gray scale version of the image, the attenuation ranging from zero to one hundred percent of a reference modulation, the level of attenuation being a function of the measure color distance.

The foregoing additional reason **claim 7**, as well as **claims 8 and 9**, which depend therefrom, is unanticipated and unobvious in light of Tretter.

Furthermore, **claims 8 and 9** recite that the level of attenuation is a non-linear function and a linear function of the color distance respectfully. In rejecting **claim 8 and 9**, the Office Action directs the attention of the applicants to col. 10, line 65 - col. 11, line 65 and asserts that Tretter discloses a contrast enhancer re-maps the luminance values to new luminance values and applies a weighting factor between 0 and 1 in a first instance and 0, .5, and 1 in a second instance. It is respectfully submitted that this disclosure is unrelated to applying an attenuated modulation to at least one pixel in the gray scale version of the image the attenuation ranging from zero to one hundred percent of a reference modulation, the level of attenuation being functional (linear or non-linear) of the measure color distance (see page 11, line 30- page 12, line 25 and Fig. 8).

For the foregoing additional reasons, **claim 8 and claim 9** are unanticipated and unobvious in light of Tretter.

In rejecting independent **claim 10**, the Office Action asserts that Tretter

discloses an image transformer which accepts an input image and transforms the image into an image having a property for contrast enhancement and asserts that this reads on the image analyzer operative to find and classify conflicting colors in the color image recited in **claim 10**. However, as explained above, Tretter does not disclose or suggest searching for conflicting colors. Instead, Tretter simply discloses equalizing or stretching a histogram of colors in an image in order to remap the pixels in the image to colors of increased contrast. Additionally, the Office Action equates the contrast enhancer of Tretter, which modifies a histogram to adjust the values of a measurable property, to the gray scale modulator recited in **claim 10**. However, as explained above, it is respectfully submitted that changing all the pixels in an image having a first value to pixels having a second value is not modulation as disclosed and claimed in the present application.

For the foregoing reasons, **claim 10**, as well as **claims 11-20**, which depend therefrom, is unanticipated and unobvious in light of Tretter.

Additionally, **claim 10** has been amended to recite a gray scale modulator operative to add spatial modulations to gray scale versions of only the conflicting colors within the single colorant version of the color image. It is respectfully submitted that Tretter does not disclose or suggest adding spatial modulations. Tretter does not disclose or suggest adding modulations to only conflicting colors and Tretter does not disclose or suggest a single colorant version of a color image.

For the foregoing additional reasons, **claim 10**, as well as **claims 11-20**, which depend therefrom, is unanticipated and unobvious in light of Tretter.

Claim 13 recites the image gray scale modulator of **claim 10** further comprises a color relationship discriminator operative to receive conflicting color classification information from the image analyzer and color image pixel information, the color relationship discriminator operative to determine a relationship between the color image pixel and the conflicting color. In rejecting **claim 13**, the Office Action asserts that Tretter discloses a color transformation, which receives the color image representation and transforms the color image to a range appropriate for the luminance-chromance representation. However, disclosure of a color transformation is not a disclosure or suggestion of a color relationship discriminator operative to receive conflicting color classification information and color image pixel

information and determine a relationship (for example a color distance) between the color image pixel and the conflicting color.

The foregoing additional reasons **claim 13**, as well as **claims 14-18**, which depend therefrom, is unanticipated and unobvious in light of Tretter.

Claim 14 has been amended to recite a spatial modulation attenuator operative to attenuate a gray scale modulation based on the relationship between the color image pixel and the conflicting color. In rejecting **claim 14**, the Office Action asserts that Tretter discloses adjusting the value of a measurable property and equates this with applying a modulation. However, even if adjusting the value of a measurable property reads on modulation, it is respectfully submitted that Tretter does not disclose or suggest doing so based on a relationship between a color image pixel and a conflicting color. The disclosure of a modified histogram used to adjust a value of a measurable property thereby producing a contrast enhanced image is simply not a disclosure or suggestion of an attenuation of modulation, texture or pattern as disclosed and claimed in the present application.

For the foregoing additional reasons, **claim 14** is unanticipated and unobvious in light of Tretter.

Claim 15 has been amended to recite a spatial modulation generator operative to generate a gray scale spatial modulation for application to a gray scale version of a color. As is explained above, Tretter does not disclose or suggest a gray scale spatial modulation.

For the foregoing additional reasons, **claim 15** is unanticipated and unobvious in light of Tretter.

Claim 16 has been amended to recite the relationship between the conflicting color and the color image pixel comprises a color distance within a color space. In rejecting **claim 16**, the Office Action asserts that Tretter discloses different color spaces for transformation. However, the disclosure of different color spaces is not the disclosure of a distance within a color space (for example, see page 7, lines 28-30 of the present application).

THE RESTRICTION REQUIREMENT

As can be seen from the discussion above, applying the spatial modulation is

simply one way to selectively add texture to portions of a single colorant version of an image. Therefore, **claims 1-3** are closely related to **claims 4-23**. It respectfully submitted that **claims 1-3** can be examined along with **claims 4-23** without an undue burden on the Examiner. Therefore, reconsideration and withdrawal of the restriction requirement is respectfully requested.

TELEPHONE INTERVIEW

In the interests of advancing this application to issue and compact prosecution, the Applicants respectfully request that the Examiner telephone the undersigned to discuss any of the foregoing with which there may be some controversy or confusion or to make any suggestions that the Examiner may have to place the case in condition for allowance.

CONCLUSION

Claims 1-3 stand withdrawn with traverse. **Claims 4-23** remain in the application. For the foregoing reasons, the case is in condition for allowance. Accordingly and further indication thereof is requested.

No additional fee is believed to be required for this Amendment A. However, the undersigned attorney of record hereby authorizes the charging of any necessary fees, other than the issue fee, to Xerox Deposit Account No. 24-0037.

In the event the Examiner considers personal contact advantageous to the disposition of this case, he/she is hereby authorized to call Joseph D. Dreher, at the Telephone Number (216) 861-5582.

Respectfully submitted,

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